

Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

Reserve

A91.44

R312

UNITED STATES
DEPARTMENT OF AGRICULTURE
LIBRARY



Reserve

BOOK NUMBER

938462

A91.44

R312

3
I
lex. 1889
HINTS TO GROWERS OF HYBRID ONION SEED

By Henry A. Jones ^{1/}, DeLance F. Franklin ^{2/}, and Elmo W. Davis ^{3/}

Introduction

Because a number of hybrids have been introduced within the past 18 months by the United States Department of Agriculture and cooperating States, many seedsmen will be producing hybrid onion seed for the first time. Thus it seems advisable to record a few things considered important in the production of hybrid onion seed. These suggestions are necessarily tentative because hybrid onion seed production is still in its infancy. They are offered because they constitute the best information we have regarding the handling of seed stocks, increase of A, B, and C lines, and the production of F₁ hybrid seed.

A number of A, B, and C lines developed by the United States Department of Agriculture and cooperating State agricultural experiment stations during the past 15 years have been distributed to seedsmen. The A line is the male-sterile line, or seed parent that is maintained by crossing with a B line; the B line is a fertile maintainer line and is self-perpetuating; and the C line is a fertile inbred line combined with the male-sterile to produce F₁ hybrid seed. A particular inbred is identified by letters and a number. The prefix to the number identifies the place of origin: B for Beltsville, Md.; P for the University of Idaho's Parma Branch Station; Ia for Iowa State College; W for the University of Wisconsin, etc. The suffix letter indicates the breeding behavior of an inbred. An A following the number shows that the line is male-sterile (S ms ms); the letter B indicates a maintainer line (N ms ms); and the letter C indicates a fertile inbred line (N Ms Ms or a line heterozygous for Ms) used as a pollinator to produce hybrid seed. However, a B line (N ms ms) may be used in lieu of a C line.

Increasing the A and B Lines in Cages

Every precaution should be taken to avoid genetic and mechanical mixtures of both seed and bulbs in all the processes of growing and handling. It is especially necessary to avoid the appearance of fertiles in the A line.

- 2a 2 U.S.
-
- 1/ Head Horticulturist, Horticultural Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, Beltsville, Md. (see 2a)
 - 2/ Superintendent, University of Idaho Branch Agricultural Experiment Station, Parma, Idaho.
 - 3/ Geneticist, Horticultural Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, Parma, Idaho.

955162

Careless techniques will soon ruin the hybrid program for a seed company; hence it is necessary to be constantly on the alert to avoid mixtures of A, B, and C lines. It seems advisable when growing mother bulbs for increase to plant all the A lines in one section of the nursery, all B lines in another section, and all C lines in another, rather than to have the various lots intermingled.

Small lots of stock seed of A and B lines should be increased only under insect-proof cages. Saran or lumite plastic screen, 20 x 20 mesh, has been used satisfactorily and has been found to exclude the smaller insects capable of carrying contaminating pollen. Steel or aluminum pipe or rod frames are ordinarily used to support the screens. These are made in panels which are wired together when put into use. Screens are equipped with heavy zippers at each corner-post in such a manner that they form a tight closure. These may be unzipped to allow easy access and to facilitate storage of the cages at the end of the pollinating season. In measuring the screens, one should allow an extra foot in height to permit closing the base of the cage with soil. This extra length of screen is also used to close off corrugates from straying insects during irrigation. Such a cage 10 feet x 20 feet x 6 feet will accommodate 5 rows of bulbs with 2 feet between rows. When productivity is good a cage of these dimensions should produce 2 to 5 pounds of stock seed, the amount depending on the lines involved and the environal conditions. In any case, equal quantities of A and B line bulbs should be planted in each cage.

Precautions should be taken to avoid contact of the umbels with the screen in such a way that the stigmas or the anthers may become exerted through the screen. Otherwise, insects carrying foreign pollen may alight upon the stigmas and contaminate the breeding stock. To avoid this possibility, stakes 5 feet long should be driven into the ground at the end of each plant row and at intervals within each row, and heavy twine should be woven back and forth from stake to stake so that the seed stalks are held in an upright position. Twine should be used in a similar manner across the ends of each cage.

A nucleus box containing 3 pounds of bees complete with comb, brood, and queen should be placed in each cage about 3 days before flowering begins to reduce any possible chance of introducing foreign pollen with the bees. To provide adequate food for the colony, both a 10 percent sugar solution and water should be placed in each cage. No. 2½ enameled tin cans equipped with burlap wicks make these readily available to the bees. These should be replenished daily to avoid undue reduction of the working force. If a nucleus box of bees becomes unduly diminished it should be replaced.

Roguing in the Cages

Despite the use of all reasonable precautions, occasional contamination is bound to occur. This necessitates careful roguing, which should be done each morning before the anthers have dehisced. This involves, above all, the removal from the male-sterile lines of plants bearing fertile pollen and those suspected of having fertile pollen. It involves also the removal of male-sterile plants occurring in the B line. Off-type plants of whatsoever nature also should be removed.

In roguing, one should take every precaution to prevent the transfer of pollen from one cage to another. Among other things, this may involve the sterilization of the hands in rubbing alcohol and making sure that no pollen adheres to the clothing. Precautions taken to prevent contamination of A and B lines in the cages will pay dividends in reduced roguing costs later.

The First Increase of A and B Lines in the Open

Regardless of the isolation provided, some contamination is bound to occur when stock seed is further increased out-of-cages. The amount of contamination can be minimized by according the fields much greater isolation than is considered adequate for open-pollinated fields. Furthermore, experience indicates that the smaller the block the greater the amount of contamination; conversely, the larger the block the less the contamination. For this reason we recommend 1 acre or more for uncaged increases. To avoid an undue amount of contamination a super-abundance of pollen from the B line should be available. For this reason we recommend that A and B lines be planted in a 1:1 ratio. Daily roguing of both A and B lines during the flowering season is always essential.

If satisfactory quantities of seed from A and B lines are realized in the first uncaged increase, enough stock seed may result for making seed of a particular F_1 hybrid for 3 or 4 years, depending on the amount of hybrid seed needed. Otherwise a second increase in the open will be required, and the same precaution should be exercised.

Seed from this second increase in the open should be used only for production of F_1 hybrids and not for further increase. This emphasizes the necessity of carrying on a stock seed program under cages concurrently with that of the uncaged increases.

C lines, like the A and B lines, should also be increased first under cages and then out-of-cages.

Roguing Mother Bulbs

Although most seedsmen will rogue mother bulbs as standard procedure, it should be re-emphasized here that off-type bulbs should be removed wherever found at each possible opportunity.

Flowering Periods of A and C Lines Should Coincide

To get the maximum amount of F_1 seed, flowering periods of A and C lines should coincide closely. In certain cases this does not normally occur, but it can be achieved by use of differential storage treatment or a differential planting date or both. For example, two of the most desirable C lines for making F_1 hybrids --B 2215 C and B 12115 C-- have a strong tendency to bloom later than many of the male-sterile lines if stored under identical conditions and planted at the same time. Work to date on B 2215 C shows that flowering of this C line can be hastened by as much as a week to 10 days by placing the bulbs at temperatures of about 45° to 50° F., while those of the early-blooming male-sterile lines are held at the usual lower temperatures, about 32° to 34° .

Ten hybrids in which B 2215 C is used as the pollen parent have been released:

Abundance	B 2108 A x B 2215 C	Elite	B 5546 A x B 2215 C
Aristocrat	B 2218 A x B 2215 C	Encore	B 2129 A x B 2215 C
Bonanza	B 2190 A x B 2215 C	Epoch	B 2264 A x B 2215 C
Champion	B 2146 A x B 2215 C	Pioneer	B 15-108 A x B 2215 C
Contender	B 2133 A x B 2215 C	Surprise	B 2207 A x B 2215 C

Seed of all of these hybrids can be produced simultaneously in a single field by using the appropriate male-sterile lines along with the common pollinator, B 2215 C. There are some differences in the flowering periods of the different A lines, but by placing approximately 25 percent of the B 2215 C bulbs at a temperature of about 50° F. for the entire storage period, satisfactory pollination of all lines can be achieved. For best results, bulbs so treated should be mixed with the untreated bulbs before the pollen row is planted in F_1 hybrid seed fields.

Since similar results have been obtained by Atkin and Davis in California with other lines, the use of a similar treatment for B 12115 C is suggested when Fiesta (B 2190 A x B 12115 C) or similar hard x soft combinations employing this C line are being made.

Other techniques, such as differential bulb planting dates, may also be developed to bring about simultaneous flowering of A and C lines.

Producing F₁ Hybrid Seed

In producing F₁ hybrid onion seed, A and C lines are alternated in the field as is done in hybrid corn seed production. Ratios of seed parents to pollen parents will probably differ with different combinations, but until we have more reliable information on this matter, we are suggesting a ratio of 4 A-line rows to 1 row of C line in an 8 to 2 arrangement.

Hybrid seed-producing fields having B 2215 C as a common pollinator could well use the following planting sequence: Contender, Abundance, Champion, Engore, Elite, Bonanza, Surprise, Aristocrat, Epoch, Pioneer. This arrangement would separate those hybrids that differ most widely and would minimize the effects of contamination.

Since bees are probably the principal pollinators, a suitable working force of these insects should be provided. Although no studies can be cited as to what constitutes an adequate bee supply, experience indicates that probably 3 or 4 hives per acre should be employed. The bees should be procured from an area where they have had wide separation from blooming onions. They should be moved in to the hybrid field as the flowers begin to open, and not before. If the bees are placed in position too early they may find other sources of nectar and pollen and fail to work the onions. Results to date indicate that hybrid seed fields should not be located near fields in which competitive flowering crops, such as alfalfa and clover, are being grown.

Where onions of different colors are involved, it is especially important that seed production fields be widely separated.

In producing hybrid seed, one should remove fertiles which may occur within the A line. This is of special importance where the blooming date of the pollen parent is later than that of the seed parent. Under such circumstances, a small quantity of the foreign pollen becomes widely disseminated and uniformity in the succeeding hybrid bulb crop is lost.



